

NEW APPROACHES FOR ESTIMATING STREAMFLOW CHARACTERISTICS IN MONTANA

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Since the 1940s, the U.S. Geological Survey (USGS) has been documenting selected basin characteristics associated with streamflow-gaging stations. These basin characteristics serve as explanatory variables for developing regression equations to estimate streamflow characteristics at ungaged stream sites. In the past, the basin characteristics were manually derived from variously scaled USGS topographic quadrangles or other maps with relevant environmental data such as soil-infiltration rate and mean annual precipitation. This process was time-consuming and regression analyses sometimes were limited by the availability of accurate and up-to-date maps and environmental data. Further, even when up-to-date data were available, the magnitude of the effort to manually assemble those data for several hundred gaging stations limited the number of explanatory variables analyzed.

In the 1980s, the development of geographic-information-system (GIS) software presented opportunities for substantial advances in compilation and analysis of topographic and environmental information for drainage basins. More recent software developments in topographic analysis and an increase in availability of geospatial datasets (including detailed soils, geology, climate, and land-cover/use data) have further automated the compilation and analysis of topographic and environmental characteristics of drainage basins.

Nationally, USGS has been pursuing many of the opportunities presented by GIS advances to improve estimation of streamflow characteristics at ungaged stream sites. In addition to more convenient derivation of traditional basin characteristics, new geospatial datasets and analytical techniques make it possible to more readily explore the hydrologic importance of other basin characteristics (such as surficial geology and several GIS-derived topographic characteristics) and to use more-detailed and accurate information related to some traditional basin characteristics (such as soil permeability and land-cover data). Also, USGS has developed software to provide estimates of streamflow characteristics at ungaged stream sites. One software program (StreamStats), developed by the USGS Office of Surface Water, is simple to use, requiring only that the user click on the stream site of interest to determine basin and streamflow characteristics. Prototype versions of StreamStats are available for several States (including Idaho, Pennsylvania, Vermont, and Washington).

In Montana, USGS is assembling and analyzing geospatial datasets to derive updated basin characteristics for streamflow-gaging stations. A preliminary comparison of GIS- and manually derived basin characteristics has shown good agreement, but a comprehensive comparison is needed. When this comparison is completed and required datasets have been prepared, USGS plans to implement StreamStats for Montana using existing geospatial datasets and USGS-developed regression equations. In conjunction with the planned implementation of StreamStats for Montana, USGS is in the process of developing new regression equations to estimate low-flow characteristics at ungaged stream sites using GIS-derived basin characteristics. These steps bring us closer to providing convenient Web-based access to basin and streamflow characteristics at ungaged sites in Montana.